Anhedonia is Associated with Altered Striatal Neurophysiology and Function in Adolescents Varying in Levels of Depression

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BACKGROUND

• Anhedonia—the reduced capacity for pleasure—is a common1 and debilitating2 feature of adolescent depression.
  
• Previous work has implicated altered reward circuitry3, which undergoes protracted maturation through adolescence4, in anhedonia; however, the role of the striatal neurophysiology remains unclear.

• Measures derived from resting-state functional magnetic resonance imaging (rsfMRI) can non-invasively provide in vivo measurements of various aspects of striatal neurophysiology.

Hypotheses: (1) Lower striatal regional homogeneity (ReHo) (Fig. 1, path b) and lower dopamine function (T2*) intensity (Fig. 1, path c) will be associated with higher levels of anhedonia. (2) Striatal tissue iron will moderate this relationship, such that lower ReHo will be most strongly linked to high levels of anhedonia at low levels of tissue iron.

METHODS

• Sample: 75 adolescents (M age = 15.30 (1.50), 46 F) participated in the study, of whom 56 scored ≥ 40 on the Children’s Depression Rating Scale-Revised (CDRS-R)19 and 19 reported no current/past self/parent psychiatric diagnosis.

• Anhedonia was assessed using the Snith-Hamilton Pleasure Scale (SHAPS)5 and other depressive symptoms using the Mood and Feelings Questionnaire (MFQ)3.

• We derived two measures from two 6-minute resting-state functional magnetic resonance imaging (rsfMRI) scans:
  
  ReHo to assess regional voxel synchronization5
  
  Normalized T2* signal to assess tissue iron3

• Data were preprocessed using fMRIPrep10.

• We used a voxel-wise moderated mediation approach to examine the relationships between T2* intensity, ReHo, and anhedonia severity, controlling for age, sex, and depressive symptoms besides anhedonia (Fig. 1).

• Clusterwise permutation testing accounted for multiple comparison corrections.

RESULTS

• Reduced striatal tissue iron in the left putamen was associated with higher levels of anhedonia (Fig. 2).

• Reduced ReHo was associated with higher levels of anhedonia in adolescents with higher striatal tissue iron in the right caudate, and with lower levels of anhedonia in adolescents with lower tissue iron.

CONCLUSIONS

• Both lower striatal ReHo and striatal tissue iron were associated with anhedonia beyond other depressive symptoms.

• However, these effects were specific to the dorsal striatum and the direction of this relationship was contingent upon levels of striatal tissue iron.

• Future research is needed to determine the effectiveness of dopamine-targeted pharmacotherapy for adolescents with anhedonia and particularly those with altered dopaminergic functioning.

REFERENCES


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Figure 1. Path diagram for moderated mediation model.

Figure 2. Simple slopes for T2* intensity effect on SHAPS score (Hypothesis 1)

Figure 3. Simple slopes for ReHo effect on SHAPS score (Hypotheses 1 + 2)

Figure 4. Moderating effect of T2* intensity on ReHo-SHAPS score simple slopes (Hypothesis 2)